NICE³
Project Fact Sheet

Uniformly Drying Material Using Microwave Energy

New system uses microwave energy to dry material uniformly at half the cost of conventional drying systems

Benefits

- Energy savings between 50% to 58% with industry-wide energy savings of nearly 500 million kWh per year
- Reduces greenhouse gas emissions by approximately 50% with 68% of particulates eliminated
- Reduces drying stress due to noncontact drying
- Fewer movable parts means lower maintenance costs
- For a plant producing 18,000 square yards per hour, 150 million square yards per year, the process can:
  - Reduce electrical usage by 3.78 million kWh per year
  - Reduce CO_2 emissions by 922 tons
  - Reduce SO_2 emissions by 8.5 tons
  - Reduce NO_x emissions by 3.5 tons
  - Reduce particulate matter by 3.4 tons

Applications

This drying method is suitable for fabrics, leather-good linings and shoes, cleaning cloths, industrial filters and insulation, medical adhesives, dressings and gowns, paper products, geotextiles, carpeting, and roofing materials, as well as personal hygiene products such as diapers.

Project Partners

NICE³ Program
Washington, DC

North Carolina Division of Pollution Prevention and Environmental Assistance
Raleigh, NC

Industrial Microwave Systems, Inc.
Research Triangle Park, NC

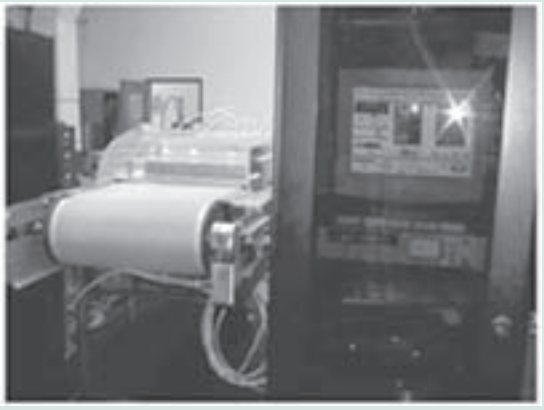
Hanes
Asheboro, NC

Industrial Microwave Systems (IMS), Inc., with assistance from a Department of Energy NICE³ grant, is demonstrating and commercializing an innovative system that utilizes microwave energy to dry material. The technology was demonstrated on apparel at a Hanes manufacturing facility in Asheboro, North Carolina.

Traditionally, microwave-drying systems have scorched portions of material that were too close to the source of radiation, while areas further away from the source remained moist. This is due to a primary characteristic of microwave energy—it attenuates as it leaves its point of origin. Aside from creating "hot spots" across the material being dried, microwave drying systems typically leak microwave energy into the surrounding environment. These negative factors have kept microwave drying from becoming the drying technology of choice.

The new technology addresses the traditional problems of microwave usage by utilizing a rectangular wave guide. This guide is slotted and serpentined to maximize the exposure area of material as it passes through the system. A number of wave guides can be cascaded together to form a system that dries an entire piece of fabric or other material. Leakage of microwave energy is greatly reduced by using choke flanges, which limit the radiation from reaching outside openings. The technology reduces emissions by a minimum of 50% and the reduction in energy consumption is equally dramatic. Industry-wide energy savings are projected to be 500 million kWh per year.

Uniformly Drying Material



Fabric passes through the wave guide of the microwave drying system, which evenly dries the material, dramatically lowering energy costs and greenhouse gas emissions.

Project Description

Goal: The project goals were to demonstrate and commercialize the patent-pending microwave technology for drying material. The efficiency, safety, and uniform drying capability of the system was tested at the Hanes plant, utilizing material from the apparel industry. Eventually, disposable diapers will be used to illustrate the variety of products that can be dried with this new process.

Traditionally, the slot for material on a microwave-drying machine has been located in the center of the wave guide. The arrangement exposes material to the maximum field intensity at all points along the guide. However, microwave signals attenuate as they pass through the material and material located away from the guide are insufficiently dried by microwave energy.

To offset the problems of uneven drying, the new method passes material through a rectangular wave guide, commonly referred to as a slotted wave guide. The guide is serpentined to maximize the exposure of the material, and a number of the guides can be cascaded together to increase the size of the drying area. The system feeds material so it compensates for the effects of microwave attenuation along the propagation path. An adjustable path length allows any peaks and valleys of an electromagnetic field in one exposure segment to compensate for the peaks and valleys of the field in another. This helps avoid “hot spots”. The material is evenly exposed to the maximum field intensity of microwave emissions. Microwave leakage into the environment is addressed by using choke flanges. These flanges prevent the escape of electromagnetic emissions by keeping the radiating structures from having a clear, straight path for microwave energy to flow outside the system.

Progress and Milestones

- Purchase and assemble equipment.
- Test, operate, and verify performance/benefits of system.
- Demonstrate technology.
- Commercialize and transfer technology.

NICE³ – National Industrial Competitiveness through Energy, Environment, and Economics:
An innovative, cost-sharing program to promote energy efficiency, clean production, and economic competitiveness in industry.
This grant program provides funding to state and industry partnerships for projects that demonstrate advances in energy efficiency and clean production technologies. Awardees receive a one-time grant of up to $525,000. Grants fund up to 50% of total project cost for up to 3 years.

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